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bodies, allied to trimethylamin, are widely distributed, but no true alkaloid has yet been found. The composition of fungi and animals shows some striking resemblances.

In gathering together the data regarding the chemistry of the higher fungi, in citing the literature, and in describing methods of isolation and identification, ZELLNER supplements acceptably the related sections of CZAPEK'S *Biochemie der Pflanzen* and facilitates further studies in this field.—C. R. B.

"Sleep" movements

In a monograph of some two hundred pages PFEFFER² describes his recent investigations on the so-called "sleep" movements of leaves. For these researches he has planned ingenious methods of securing the self-registration of the movements of simple leaves, or the folding of a number of leaflets. In addition to the clever arrangements of levers, he has devised several forms of registering apparatus, and methods for continuous and intermittent illumination, in which the disturbing effects of varying temperature are eliminated, and at will a sudden or gradual illumination is secured, by electric tungsten or mercury lamps, without sparking at the contacts. These methods and apparatus will doubtless prove of very great service, not only in the study of "sleep" movements, but also wherever, as in this case, optical methods of record are not suitable.

The records published in this monograph, giving for the first time the autographs of leaves subjected to varying conditions of light and temperature, are likely to become classic illustrations. They show not only the so-called "sleep" movements, but also the independent autonomous movements which often accompany them, and the interesting rhythmic movements that persist for some time when the leaves are kept in uniform conditions. The work is one which will take its place with other monographs of this author as a permanent contribution to plant physiology. The contribution, however, lies rather in the useful apparatus and in the direct results recorded than in any theoretical considerations which are deducible.

The "sleep" movements, whether they are executed by growth or turgor, are herein definitely shown to be photonastic or thermonastic reactions, called forth by the daily change of illumination or temperature, or by the co-operation of both factors. That being the case it is to be regretted that the author does not adopt some more suitable term than the misleading *Schlafbewegungen*. When under constant conditions the "sleep" movements gradually disappear in 3-5 days through after-movements of diminishing amplitude, there often remain autonomous movements of much shorter rhythm, which are quite independent of the others. Many specific peculiarities in the responses are described, which cannot be here enumerated. Thermonastic responses show similar peculiarities and the photonastic reactions seem bound up, to a certain extent, with them, since in most leaves thermonastic responses may be induced when the photonastic ones have

² PFEFFER, W., Untersuchungen über die Entstehung der Schlafbewegungen der Blattorgane. Abh. Math.-phys. Kl. Königl. Sächs. Gesells. Wiss. 30: 259-472. figs. 36. 1907. Separately of B. G. Teubner, Leipzig. M 8.

been excluded, and *vice versa*. The natural rhythm of response may be increased or diminished, provided the latent period of the organ is less than the daily period of light and darkness.

This work is one that will be needed in every active laboratory, so that any more detailed statements of its conclusions would be superfluous.—C. R. B.

NOTES FOR STUDENTS

Plant breeding.—Bulletins of the various Agricultural Experiment Stations usually deal with the practical side of agricultural problems, and there has not been at all times a recognition of the practical value of theoretical matters emanating from pure scientific sources.

One can only commend the purpose of Dr. E. M. EAST³ in issuing a bulletin in which a well-written review of the development of the evolution idea is given, along with the more recent developments in our knowledge of variations and of heredity. In the main the treatment is well balanced, but in some respects there is too obvious a leaning on MORGAN's recent publications. Particularly does it seem out of place, in so brief a paper, to present MORGAN's theory of the impurity of the gametes—a theory which has lost practically all the slight support it seemed to have when first propounded.

It is noted on p. 68 in the discussion of the Belgian-hare cross, as an illustration of "masked" characters, that the older explanation is retained, based upon the supposed presence of a black factor in the albino. CASTLE⁴ has given a more satisfactory explanation of such cases by assuming an "agouti factor" which distributes the pigment in distinct regions in each hair, giving a grey effect. The Belgian hare of the experiment cited had both dominant characters, namely pigment and agouti, and the albino lacks them both. The advantage of CASTLE's explanation lies in the fact that it brings such cases into harmony with the "presence and absence" hypothesis which has found such wide support in other cases and to which the author of the bulletin himself subscribes.

The section on "Methods of plant improvement" is doubtless the most valuable part of the paper. Its scope may be indicated by the subheads: "The selection of fluctuations," "Isolation of elementary species," "Judging plants by their progeny," "Correlated characters," "Improvement by hybridization." Under the first of these subheads a valuable summary is given of the results gained by HOPKINS and his associates at the Illinois Experiment Station in the breeding of maize for high and low protein and high and low oil content. The crop averages for ten years are given, showing that in this time the maximum separation of the extremes with respect to these characters seems to have been attained.

³ EAST, E. M., The relation of certain biological principles to plant breeding. Conn. Agric. Exp. Sta., Bull. 158. pp. 93. figs. 6. 1907.

⁴ CASTLE, W. E., On a case of reversion induced by cross breeding and its fixation. Science N. S. 25:151-153. 1907.